

Space Weather Forecast

Issued on Tuesday, 21 February 2023 at 12:45 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Minor/Moderate R1/R2 radio blackouts likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been moderate in the past 24 hours with a Moderate-class flare at 20/1458UTC from a region in the Sun's northeast. This group also produced a doublet of high-end Common-class flares and a further peak Moderate-class later in the 24-hour period to make it the most notable region on the Sun. This group is currently near the northeastern solar horizon which is hampering full analysis, however it appears to have rapid areal growth in its trailing spots.

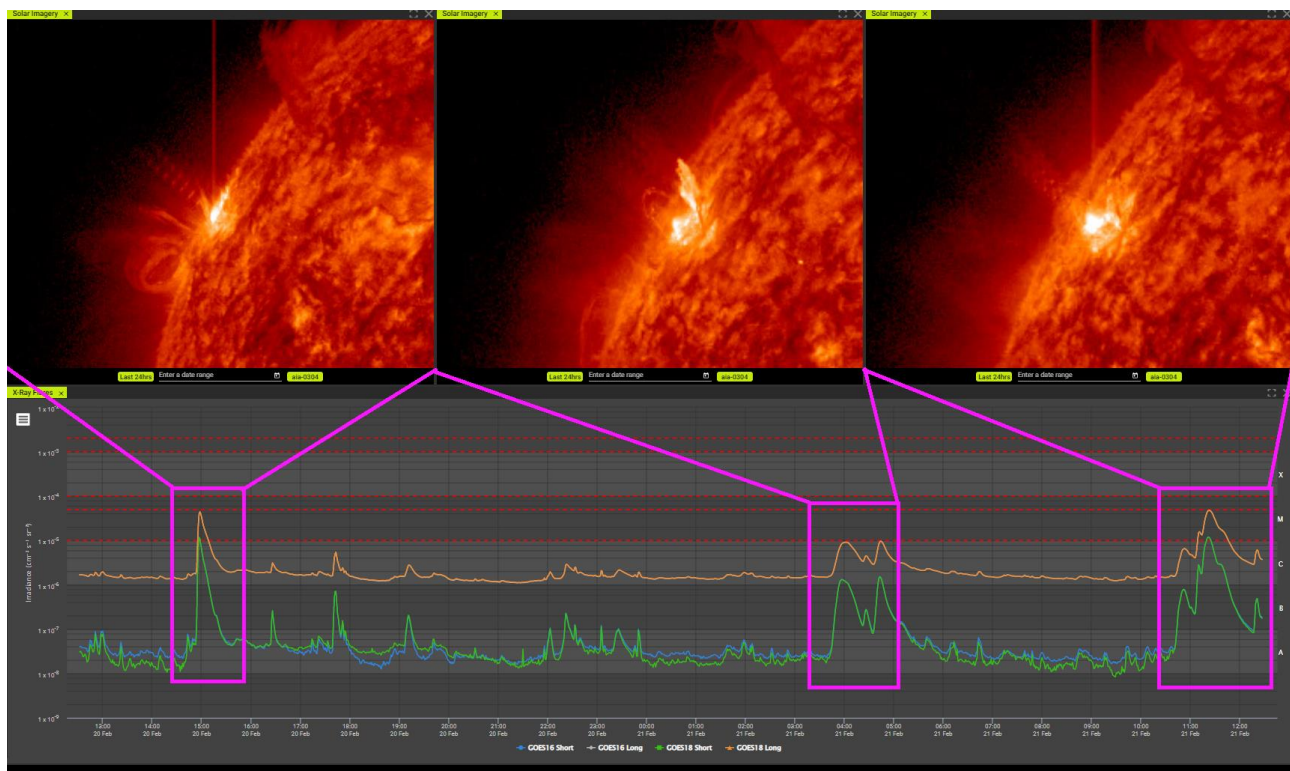


Figure 1: Top: false-colour extreme UV satellite imagery of the Sun, showing a proxy for X-ray activity in the most complex sunspot group on the Sun at present. Bottom: measure of X-ray flux at satellites in geostationary Earth orbit (where M=Moderate, C=common class).

The above was one of seven regions on the Sun at present. Most of these were either stable and magnetically unipolar or else in decay, including the strong class-producing sunspot group (dating from 17 February), which has seen overall areal decline - usually indicative of a lessening risk of further such activity.

A few Coronal Mass Ejections (CMEs) were visible in available satellite imagery for the period, Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

however only one is currently considered to possibly lead to any effect at Earth - a front-sided CME heading largely above and ahead of the Earth's track was tentatively traced back to activity high in the Sun's outer atmosphere around the turn of the UTC day. This CME has been analysed but modelling results are pending - any effect from this is likely to be minor and related to the shock only - later this working week. This will be confirmed when results become available.

Solar Wind / Geomagnetic Activity: Solar winds were indicative of ongoing CME influence from the 17 February strong class-tied event, which arrived at Earth 20/1045UTC to muted geomagnetic effect. A waning tendency to a slow wind is probably now in course, i.e. Earth is sampling the outer 'shock' of the CME only given the glancing incidence, all without fully going into the CME's main core (its magnetic cloud).

The solar wind speed has been mostly slightly elevated in the period, with a slight decrease observed with time. The number of particles in the solar wind has shown a similar slight decrease from slightly elevated to background levels. the magnetic field associated with these particles has also been slightly elevated and erratic in character, peaking both to start and end the 24 hours. The north-south component was mainly erratic about being neutrally-orientated, but gradually transitioned to become mainly anti-aligned with the Earth's field later in the period (usually to greater effect).

The net result of the above solar wind measures has nevertheless been provisionally mostly quiet despite the CME, peaking comfortably below Minor Geomagnetic Storm G1.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate solar activity is likely, with the presence of both the strong class-producing group and now a new potent and growing region in the northeast. Both of these dominant groups should be present throughout the four days.

Solar Wind / Geomagnetic Activity: There is one low confidence CME in the forecast - that which left the southwest of the Sun on 19 February, although any influence should be from the shock only (i.e. minor) and even this is low confidence, passing Earth's orbit later Wednesday 22 or into Thursday 23 February (UTC). There is now also one other candidate from the northwest undergoing modelling - with results to be confirmed.

The above excepted, Earth should see a slow wind regime transition to a fast one in a 'coronal hole' high speed stream during the UTC morning of day two, Wednesday 22 February, giving a peak slight chance of Minor Geomagnetic Storm G1 for the four-day period, reducing with time to largely quiet conditions by the end of the current UTC week (with moderate confidence given the possibilities of CME shocks).

Energetic Particles / Solar Radiation: Solar radiation carries a slowly increasing slight chance of rising towards the S1 level, perhaps exceeding it, should any suitable larger flares occur.

Geomagnetic Storms:

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	10	20	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	60	60	50	50
Very Active	R3 to R5 X	No	10	10	10	10

Solar Radiation Storms - (High Energy Protons):

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)